ABC of intensive care

Transport of critically ill patients

Peter G M Wallace, Saxon A Ridley

Intensive care patients are moved within hospital—for example, to the imaging department—or between hospitals for upgraded treatment or because of bed shortages. We will concentrate on transport of adults between hospitals, but the principles are similar for transfers within hospitals.

Although the Intensive Care Society and the Association of Anaesthetists have recommended that retrieval teams are established in the United Kingdom, 90% of patients are accompanied by staff from the referring hospital. Over 10 000 intensive care patients are transferred annually in the United Kingdom, but most hospitals transfer fewer than 20 a year. Each hospital thus has little expertise and few people gain knowledge of transport medicine. Most patients are accompanied by on call anaesthetic trainees. Not only does this leave the base hospital with inadequate on call staff but accompanying doctors often have little experience.

Principles of safe transfer

- Experienced staff
- Appropriate equipment and vehicle
- Full assessment and investigation
- Extensive monitoring
- Careful stabilisation of patient
- Reassessment
- Continuing care during transfer
- Direct handover
- Documentation and audit

Dangers of transport

Intensive care patients have deranged physiology and require invasive monitoring and organ support. Furthermore, they tend to become unstable on movement. Transport vehicles are not conducive to active intervention and no help is available. Staff and patients are vulnerable to vehicular accidents and may be exposed to temperature and pressure changes.

Audits in the United Kingdom suggest that up to 15% of patients are delivered to the receiving hospital with avoidable hypotension or hypoxia which adversely affects outcome. About 10% of patients have injuries that are undetected before transfer. However, with experienced staff, appropriate equipment, and careful preparation, patients can be moved between hospitals without deterioration. The "scoop and run" principle is not appropriate for moving critically ill patients.

Specially equipped ambulances are best for transferring patients

Organisation

Each hospital should have a designated consultant responsible for transfers who ensures that guidelines are prepared for referral and safe transfer, equipment and staff are available, and standards are audited. Proper routines for referral between hospitals and good communication should ensure appropriate referral, coordination, and integration of services. An area or regional approach may allow retrieval teams to be established.

Organisational structure

National and regional

Department of Health, purchasers, and specialist societies have responsibility for

- Guidelines
- Audit
- Bed bureau
- Funding
- Regional retrieval teams

Hospital or trust

Consultant with overall responsibility for transfers including

- Local guidelines, protocols, check lists
- Coordination with neighbouring hospitals
- Availability and maintenance of equipment
- Nominated consultant for 24 hour decisions
- Call out system for appropriate staff
- Indemnity and insurance cover
- Liaison with ambulance service concerning specification of vehicle and process of call out
- Communication systems between units and during transfer
- Education and training programmes
- Audit: critical incident, morbidity, and mortality
- Funding: negotiations with purchasers

Transfer decisions

A decision to transfer should be made by consultants after full assessment and discussion between referring and receiving hospitals. Guidelines exist concerning timing of transfer for certain groups of patients—for example, those with head injury. For patients with multiple organ failure the balance of risk and benefit needs to be carefully discussed by senior staff.

The decision on whether and how to send or retrieve a patient will depend on the urgency of transfer, the availability and experience of staff, equipment, and any delay in mobilising a retrieval team. Local policies should be prepared to reflect referral patterns, available expertise, and clinical circumstances.

Transfer vehicle

Vehicles should be designed to ensure good trolley access and fixing systems, lighting, and temperature control. Sufficient space for medical attendants, adequate gases and electricity, storage space, and good communications are also important. The method of transport should take into account urgency, mobilisation time, geographical factors, weather, traffic conditions, and cost.

Road transfer will be satisfactory for most patients. This also has the advantages of low cost, rapid mobilisation, less weather dependency, and easier patient monitoring. Air transfer should be considered for longer journeys (over about 50 miles (80 km) or 2 hours). The apparent speed must be balanced against organisational delays and transfer between vehicles at the beginning and end. Helicopters are recommended for journeys of 50-150 miles (80-240 km) or if access is difficult, but they provide a less comfortable environment than road ambulance or fixed wing aircraft, are expensive, and have a poorer safety record. Fixed wing aircraft, preferably pressurised, should be used for transfer distances over 150 miles (240 km).

Close liaison with local ambulance services is required. Contact numbers should be available in all intensive care units and accident and emergency departments to ensure rapid communication and advice.

Comfort and safety of patients and staff are important

Equipment

Equipment must be robust, lightweight, and battery powered. The design of transport equipment has advanced greatly, and most hospitals now have the essentials. Many ambulance services also provide some items in standard ambulances.

Equipment for establishing and maintaining a safe airway is essential. Another prerequisite is a portable mechanical ventilator with disconnection alarms which can provide variable inspired oxygen concentrations, tidal volumes, respiratory rates, levels of positive end expiratory pressure, and inspiratory:expiratory ratios. The vehicle should carry sufficient oxygen to last the duration of the transfer plus a reserve of 1-2 hours.

A portable monitor with an illuminated display is required to record heart rhythm, oxygen saturation, blood pressure by non-invasive and invasive methods, end tidal carbon dioxide, and temperature. Alarms should be visible as well as audible because of extraneous noise during transfer. Suction equipment and a defibrillator should be available. A warming blanket is advantageous. The vehicle must also contain several syringe pumps with long battery life and appropriate drugs. A mobile phone for communication is advisable.

One person should be responsible for ensuring batteries are charged and supplies fully stocked. All those assisting in the transfer should know where the equipment is and be familiar with using the equipment and drugs.

If patients are transferred on standard ambulance trolleys equipment has to be carried by hand or laid on top of the patient, which is unsatisfactory. Special trolleys should be used that allow items to be secured to a pole or shelf above or below the patient.

Portable ventilator, battery powered syringe pumps, and monitor

Trolley with shelf for equipment makes moving patients easier and safer

Accompanying staff

In addition to the vehicle's crew, a critically ill patient should be accompanied by a minimum of two attendants. One should be an experienced doctor competent in resuscitation, airway care, ventilation, and other organ support. The doctor, usually an anaesthetist, should ideally have training in intensive care, have

carried out previous transfers, and preferably have at least two years' postgraduate experience. He or she should be assisted by another doctor, nurse, paramedic, or technician familiar with intensive care procedures and equipment. Current staffing levels in many district general hospitals mean that this ideal is not always achievable.

The presence of experienced attendants will not only ensure that basics for ensuring safe transfer are undertaken but prevent transfers being rushed without full preparation; this often requires a senior voice. Hospitals should run regular training programmes in safe transport techniques.

Provision must be made for adequate insurance to cover death or disability of attendants in an accident during the course of their duties. The hospital trust should provide medical indemnity, and personal medical defence cover is also recommended.

Patients should be accompanied by an experienced doctor and another trained member of staff

Preparation

Meticulous stabilisation of the patient before transfer is the key to avoiding complications during the journey. In addition to full clinical details and examination, monitoring before transfer should include electrocardiography, arterial oxygen saturation, (plus periodic blood gas analyses), blood pressure preferably by direct intra-arterial monitoring, central venous pressure where indicated, and urine output. Investigations should include chest radiography, other appropriate radiography or computed tomography, haematology, and biochemistry. If intra-abdominal bleeding is suspected the patient should have peritoneal lavage.

Intubating a patient in transit is difficult. If the patient is likely to develop a compromised airway or respiratory failure, he or she should be intubated before departure. Intubated patients should be mechanically ventilated. Inspired oxygen should be guided by arterial oxygen saturation and blood gas concentrations. Appropriate drugs should be used for sedation, analgesia, and muscle relaxation. A chest drain should be inserted if a pneumothorax is present or possible from fractured ribs.

Intravenous volume loading will usually be required to restore and maintain satisfactory blood pressure, perfusion, and urine output. Inotropic infusions may be needed. Unstable patients may need to have central venous pressure or pulmonary artery pressure monitored to optimise filling pressures and cardiac output. Hypovolaemic patients tolerate transfer poorly, and circulating volume should be normal or supranormal before transfer. A patient persistently hypotensive despite resuscitation must not be moved until all possible sources of continued blood loss have been identified and controlled. Unstable long bone fractures should be splinted to provide neurovascular protection.

It is important that these measures are not omitted in an attempt to speed transfer as resultant complications may be impossible to deal with once the journey has started.

A gastric drainage tube should be passed and all lines and tubes securely fixed. Equipment should be checked including battery charge and oxygen supply. Case notes, *x* ray films, a referral letter, and investigation reports should be prepared and blood or blood products collected. The receiving unit should be informed of the estimated time of arrival.

Travel arrangements should be discussed with relatives. They should not normally travel with the patient.

Transfer

Care should be maintained at the same level as in the intensive care unit, accepting that in transit it is almost impossible to

Is your patient ready for transfer?

Respiration
- Airway safe?
- Intubation and ventilation required?
- Sedation, analgesia, and paralysis adequate?
- Arterial oxygen pressure >13 kPa? saturation $>95\%$?
- Arterial carbon dioxide pressure 4-5 kPa? (fit young adult)

Circulation
- Systolic blood pressure >120 mm Hg?
- Heart rate <120 beats/min?
- Perfusion OK?
- Intravenous access adequate?
- Circulating volume replaced?
- Blood needed?
- Urine volumes?
- Continuing bleeding? Site?

Head
- Glasgow coma score? Trend?
- Focal signs?
- Pupillary response?
- Skull fracture?

Other injuries
- Cervical spine, chest, ribs?
- Pneumothorax?
- Bleeding—intrathoracic or abdominal?
- Long bone or pelvic fractures?
- Adequate investigation?
- Adequate treatment?

Monitoring
- Electrocardiography?
- Pulse oximetry?
- Blood pressure?
- End tidal carbon dioxide pressure?
- Temperature?
- Central venous pressure, pulmonary artery pressure, or intracranial pressure needed?

Investigations
- Blood gases, biochemistry, and haematology sent?
- Correct radiographs taken?
- What else is needed? computed tomography, peritoneal lavage, laparotomy?

Departure checklist
- Do attendants have adequate experience, knowledge of case, clothing, insurance?
- Appropriate equipment and drugs?
- Batteries checked?
- Sufficient oxygen?
- Trolley available?
- Ambulance service aware or ready?
- Bed confirmed? Exact location?
- Case notes, *x* ray films, results, blood collected?
- Transfer chart prepared?
- Portable phone charged?
- Contact numbers known?
- Money or cards for emergencies?
- Estimated time of arrival notified?
- Return arrangements checked?
- Relatives informed?
- Patient stable, fully investigated?
- Monitoring attached and working?
- Drugs, pumps, lines rationalised and secured?
- Adequate sedation?
- Still stable after transfer to mobile equipment?
- Anything missed?

intervene. Monitoring of arterial oxygen saturation, expired carbon dioxide tensions, heart rhythm, temperature, and arterial pressure should be continuous. As non-invasive measurement of blood pressure is affected by movement, intra-arterial monitoring is recommended.

Transfer should be undertaken smoothly and not at high speed. A record must be maintained during transfer. Despite careful preparation unforeseen clinical emergencies may occur; the vehicle should then be stopped at the first safe opportunity to facilitate patient management.

Handover

On arrival there must be direct communication between the transfer team and the team who will assume responsibility for the patient. A record of the patient's history, treatment, and important events during transfer should be added to the notes. Radiographs, scans, and results of other investigations should be described and handed over. The transfer team should retain a record of the transfer on a prepared form for future audit.

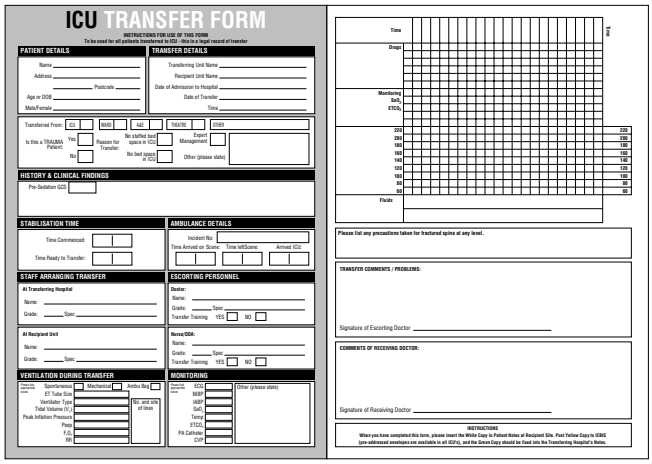
The receiving hospital should provide refreshments and arrange for staff to return to base. Money or credit cards should be available for use in emergencies.

Audit, training, and funding

Regular audit of transfers is necessary to maintain and improve standards. The responsible consultant should review all transfers in and out of the hospital, and a similar process should be established at regional and national level.

Before taking responsibility for a transfer, staff should receive training and accompany patients as an observer. Resources are required to achieve this and to ensure safe transfer systems throughout the United Kingdom. Purchasers should reflect this in their budgetary priorities.

The patient transfer form was provided by ICBIS.



Form for recording patient transfer information

Peter G M Wallace is consultant anaesthetist, Western Infirmary, Glasgow G11 6NT and Saxon A Ridley is director of intensive care, Norfolk and Norwich Hospital, Norwich NR1 3SR

The ABC of intensive care is edited by Mervyn Singer, reader in intensive care medicine, Bloomsbury Institute of Intensive Care Medicine, University College London and Ian Grant, director of intensive care, Western General Hospital, Edinburgh. The series was conceived and planned by the Intensive Care Society's council and research subcommittee.

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The ladder of truth

The story of a mother and her son

This story was told to me by Christopher's mother and related to a conversation they had when he was about 6. At the time he was attending a cystic fibrosis clinic where he came to know Rosie, another patient about the same age. Sadly, Rosie died shortly afterwards.

One day, a little later, while perched on the draining board watching his mother wash up, Christopher dropped his bombshell by asking whether he had cystic fibrosis, whether he would always have it, and whether he, like Rosie, would die. She answered each question simply and truthfully.

To keep the ball in the air, she then asked Christopher if he was afraid of dying. He admitted that he was. Now, wisely assuming nothing, she explored this statement by asking what exactly he was afraid of. His answer was a bit unexpected, as children's answers so often are. He said that he was afraid of being put under the ground. Now this presented no problem for Christopher's mother as she was able to explain in spiritual terms, consistent with their family beliefs, that a body was just like an overcoat which, when it became damaged or old and of no further use, was discarded. When Christopher died, she explained, his body would be like the overcoat. Christopher, being in Heaven, would no longer need it, so burying it was fine.

The way that Christopher's mother handled this difficult conversation illustrated that truth is not just the opposite of a lie, nor is truth necessarily the whole truth. It is, in fact, more like a ladder. No child of questioning age is right at the bottom knowing nothing, nor right at the top knowing everything. They will be somewhere in between.

Our job, as parents and professionals, is to try and discover where they are and to join them there. We can do this, when the occasion arises, by listening and by asking age appropriate, non-threatening questions. When we get some idea of where children are on the ladder, next comes the most vital part of all: it is their prerogative to choose whether they wish to stick there or to go up a rung or two. If they choose to go up, which they will indicate by asking questions, then we go with them but only one step at a time. This means we are never required to give children information which they may neither want nor understand. It must be a gentle ascent up the ladder with the children leading and with us holding their hand all the way.

Instinctively, Christopher's wise and sensitive mother adopted the ladder concept. She found out where he was by attentive listening and went up the ladder with him at his chosen pace, never jumping ahead or anticipating his thinking. Many of us have learnt important lessons from her, and she was able to give Christopher the comfort and confidence he sought. Christopher died in his late teens while awaiting a heart and lung transplant, but up until the end of his life he and his mother kept the open and trusting relationship evident in this early conversation.

Olive McKendrick, *retired paediatrician, Liverpool*